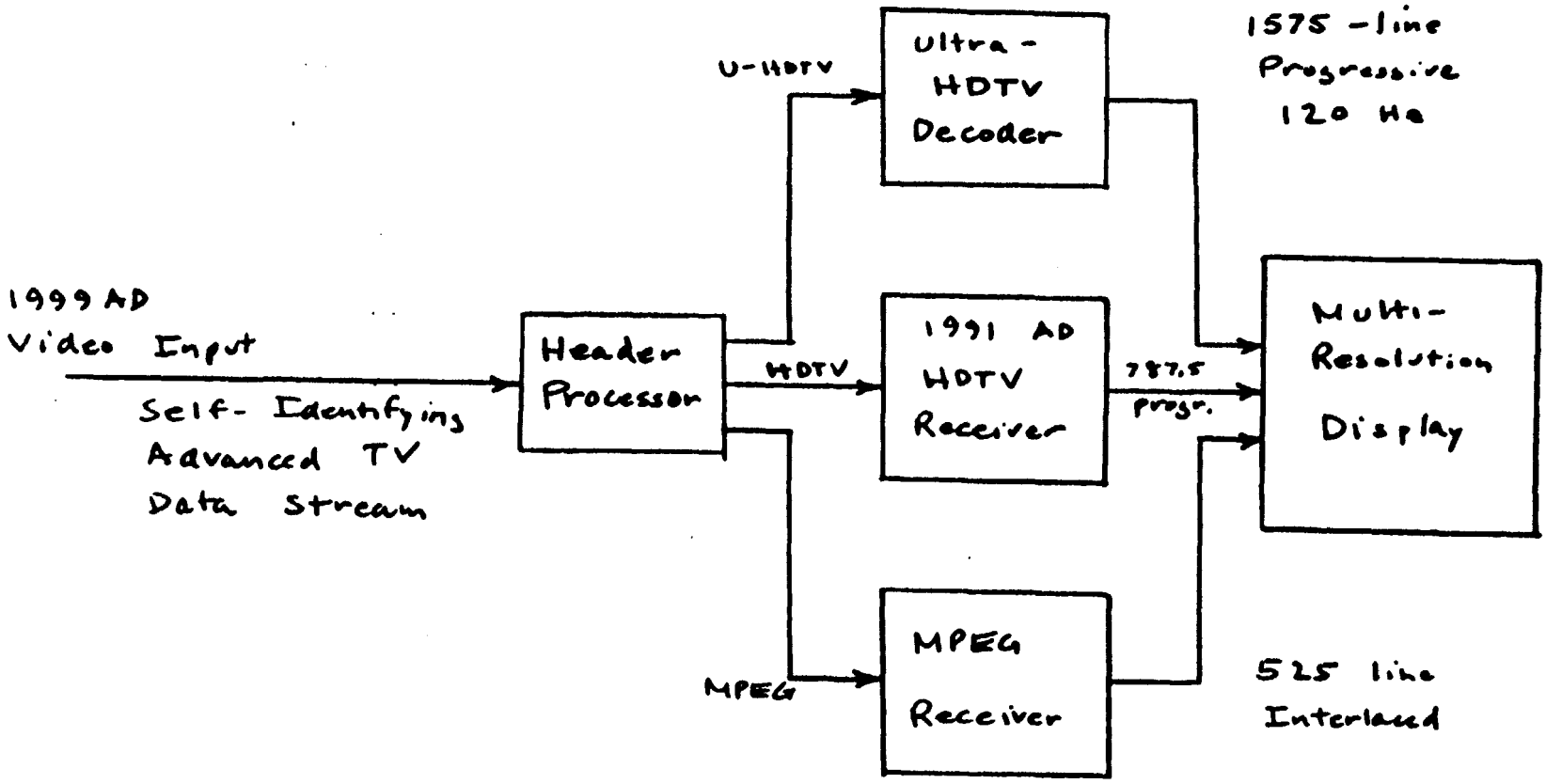
Fig. 5.3



Example of Extensibility

Additional Example of Extensibility

Consistent family of headers:
- Images will always by decodable (immortal)

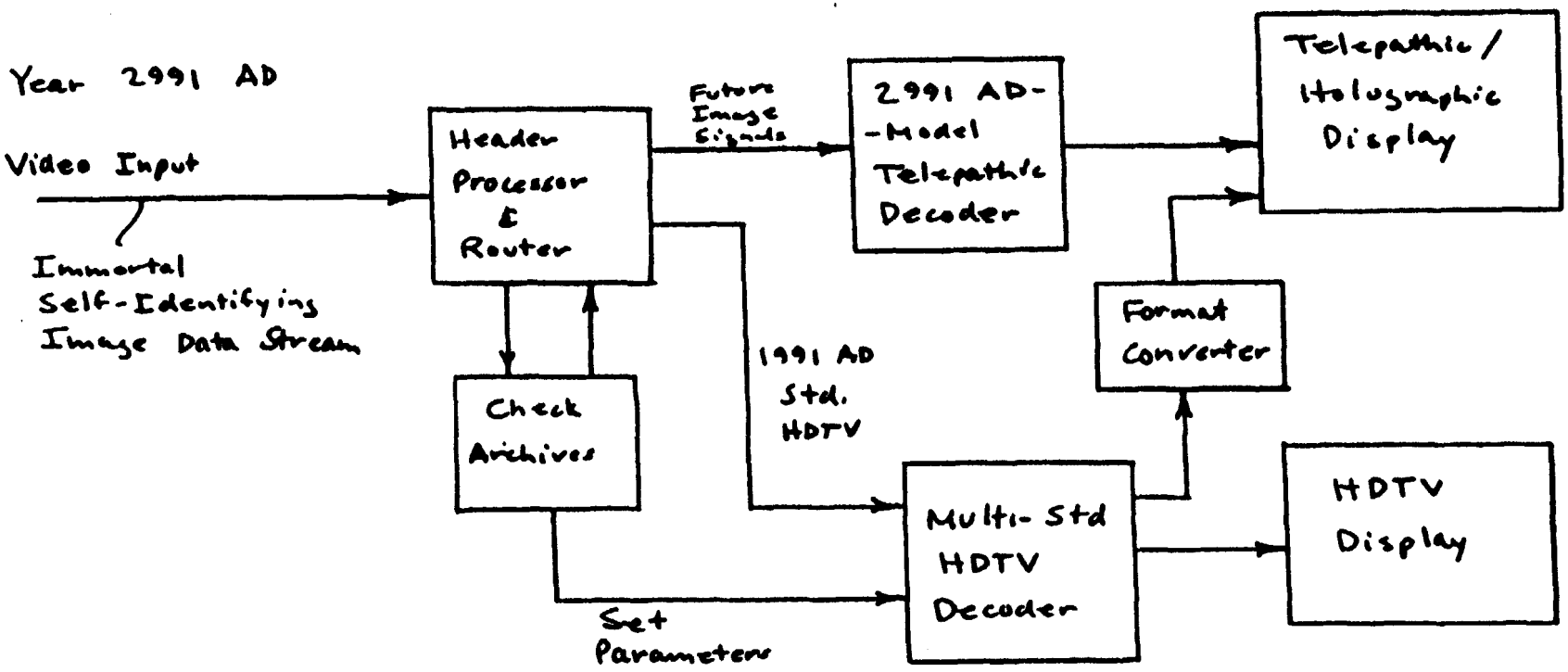
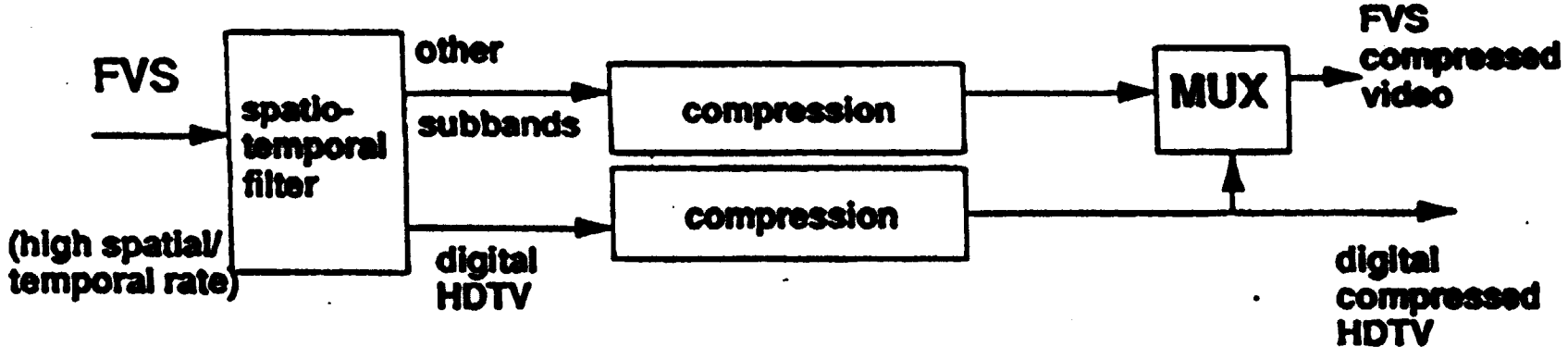


Fig. 4

Extensibility Example

- **Extension to a future video system with higher spatial resolution and frame rate.**



Progressive scan/square pixels allow simple spatio-temporal filter to decompose FVS signal into HDTV and the remaining

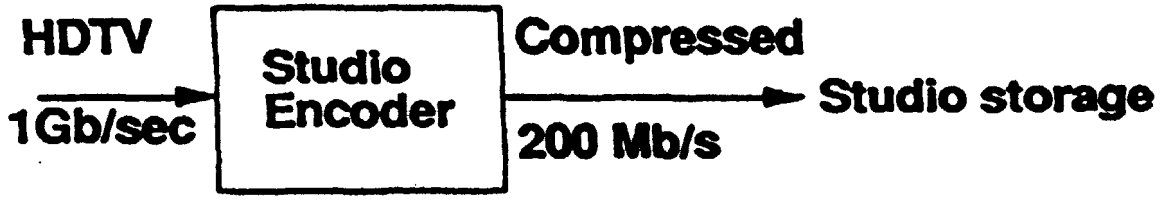
Extensibiltiy Example

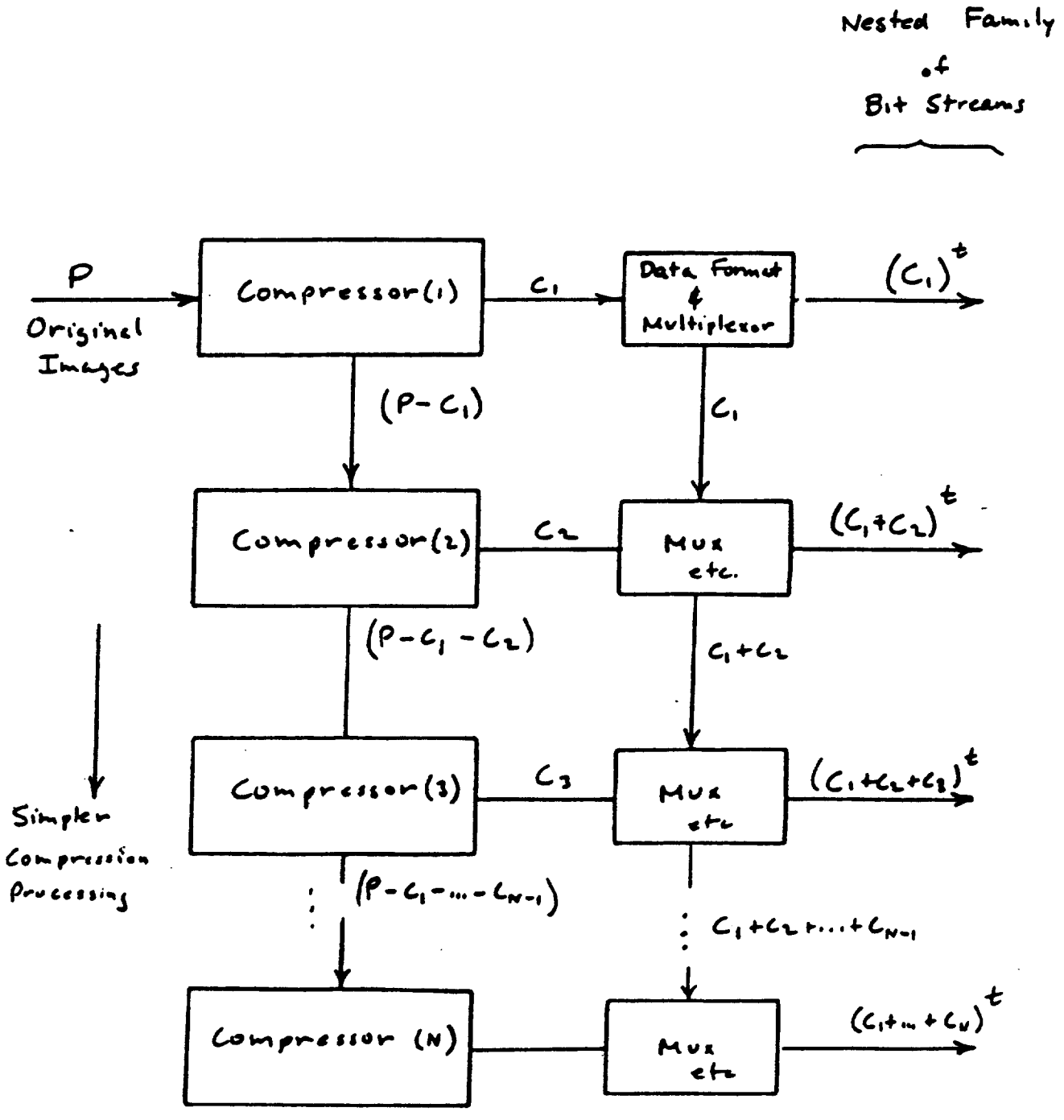
- **Extension of compression algorithm for storage/processing in studio**

  Requirements

  - **perfect picture after multiple encoding/decoding**
  - **no frame-to-frame processing**
  - **ability to do special effects (eg., chroma-key) after encoding**

FIG. 6





Example of Layered Coding

Fig. 7

Scalability Example

- Display of reduced resolution HDTV in workstation windows

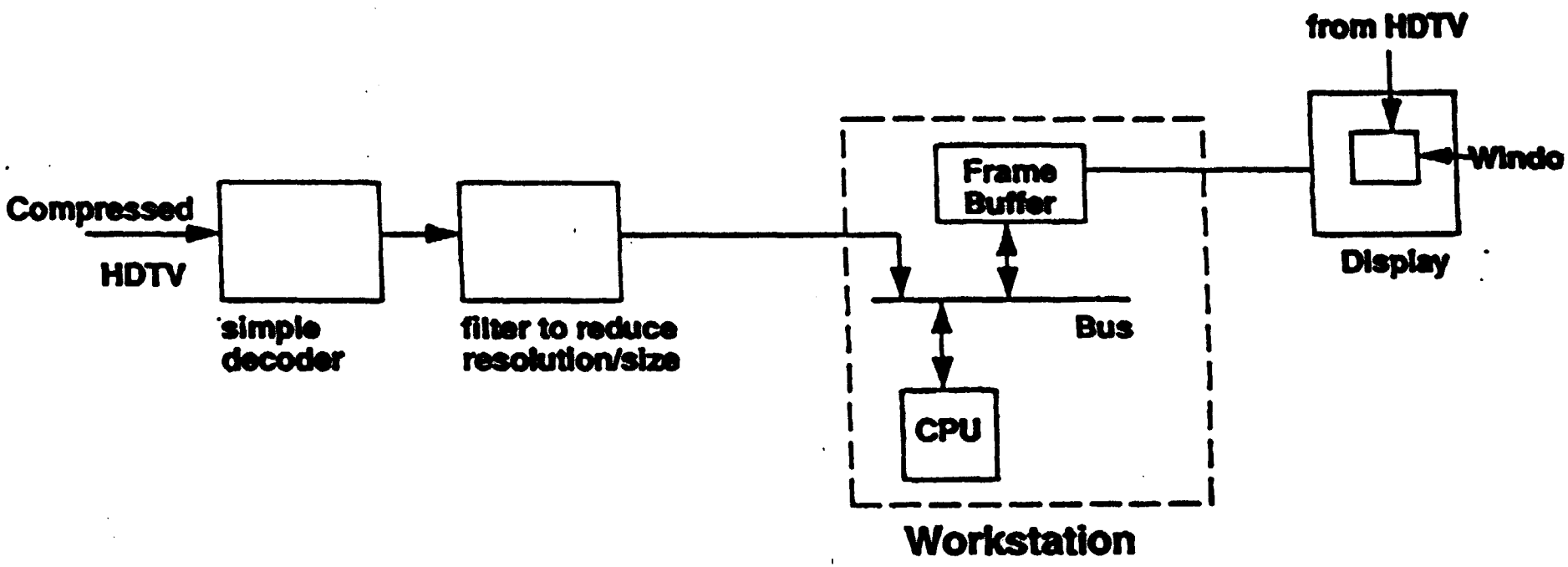
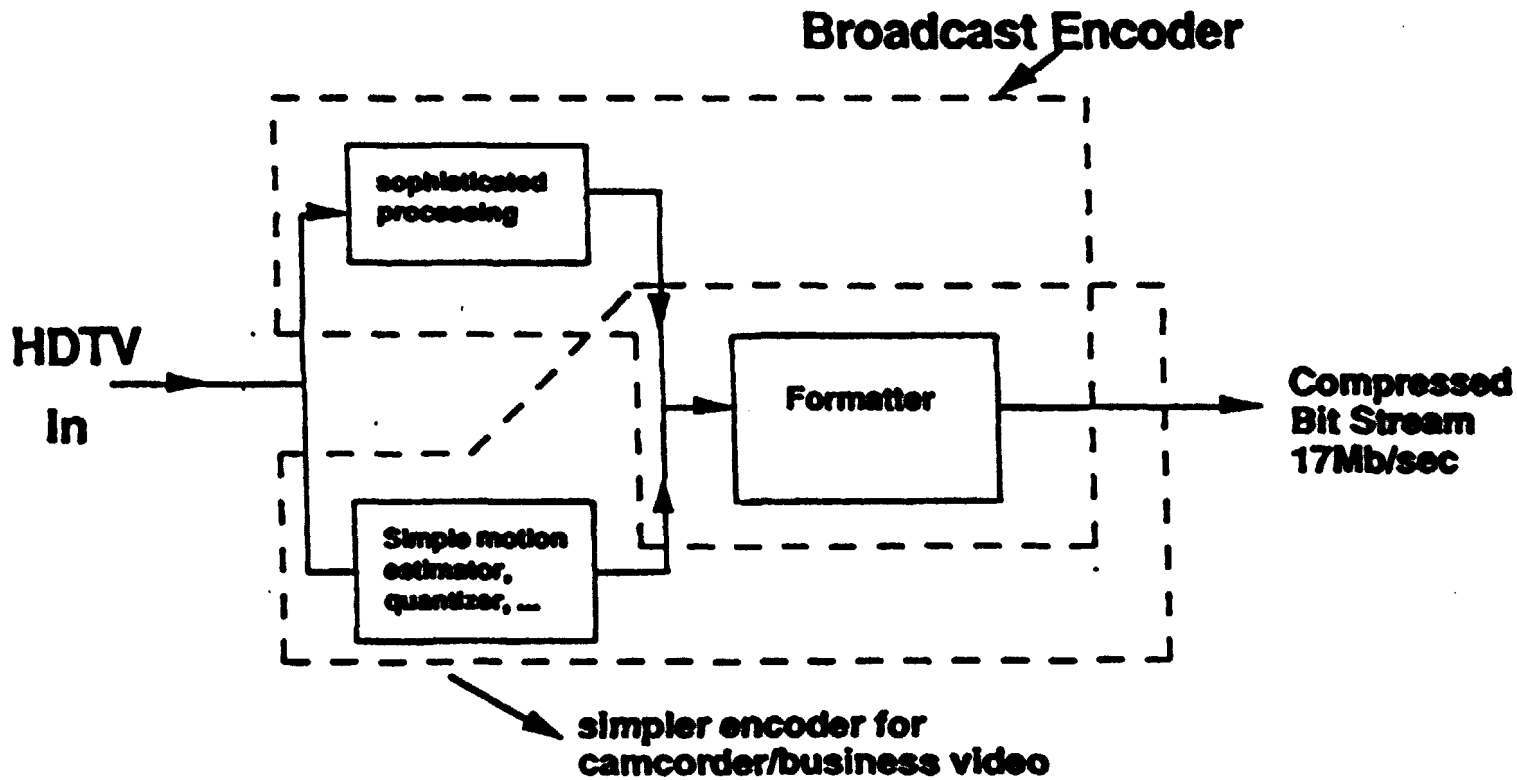


Fig. 8

Scalability Example

- For broadcast applications, encoder more complex to give good picture quality but it is modular ⇒ can handle applications requiring low encoder cost



- Simply related scanning parameters (to NTSC, PAL) make down coversion easy

Fig. 9

Attachment B: Reference Models / Architecture.

Advisory Committee on Advanced Television (ATV) Service
Planning Subcommittee -Working Party 4
Alternative Media Technology and Broadcast Interface

Working Group on Graphic Reference Models
December 1991

Interim Report:

Objective: Develop a set of graphics illustrating criteria and techniques for measurement of relationships between advanced broadcast television and other communications media and channels.

Notes on the Illustrations:

Figure 1. A Standard Reference Model for Interoperability
This chart supports a recommendation for case by case measurement of Interoperability of advanced television system proposals in relationship to a ranked list of all related alternative media and channels. Alternative media and channels should be ranked in order of importance by weighted economic, social, factors along practical timelines.

Three evaluation points for each media transformation or channel transmission are *1. System complexity, 2.Cost* of required hardware and software, and *3 .Image and audio quality .*

Four reference layers are shown for analysis of the complexity of each alternative media transformation. and channel transmission 1.Application, 2. Picture,3.Compression, and 4.transmission.

Figure 2. Standard Transformations
Three standard transformations for advanced television are shown: 1. ATV Image to listed communications channels and related video media. 2. hierarchical relationships between ATV and lower resolution television, computer, CD-ROM (MPEG, etc.) and video telephone. and 3.Image to Image transformation with equivalent or superior resolution standard image formats.

Figure 3. A Data Flow Model
Macro-relationships and communications channels are shown for media production, distribution, and consumption.

Figure 4. A timeline of deployment of interoperable media and channels and devices.

Figures 5., 6., 7. Bullet point explanations and definitions of the layered model for measurement of advanced television for interoperable complexity and costs.

Figures 8., 9., 10., 11. Show the layered relationships within two similar proposed models.

Figure 12. Illustrates a proposed definition of *interoperability.*

Figure 13. Illustrates a proposed definition of *extensibility.*

Figures 14. and 15. Illustrate a proposed definition of *scalability.*

Figure 16. Illustrates the role and benefits of a *universal video header.*

Contributors:

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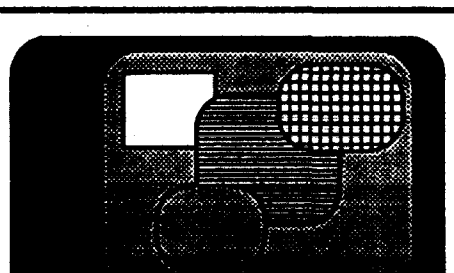
Standard Reference Model for Interoperability



HDTV

Metrics for each Transformation

1. Cost
2. Complexity

Reference layers:
- Application
- Picture
- Compression
- Transmission

3. Quality

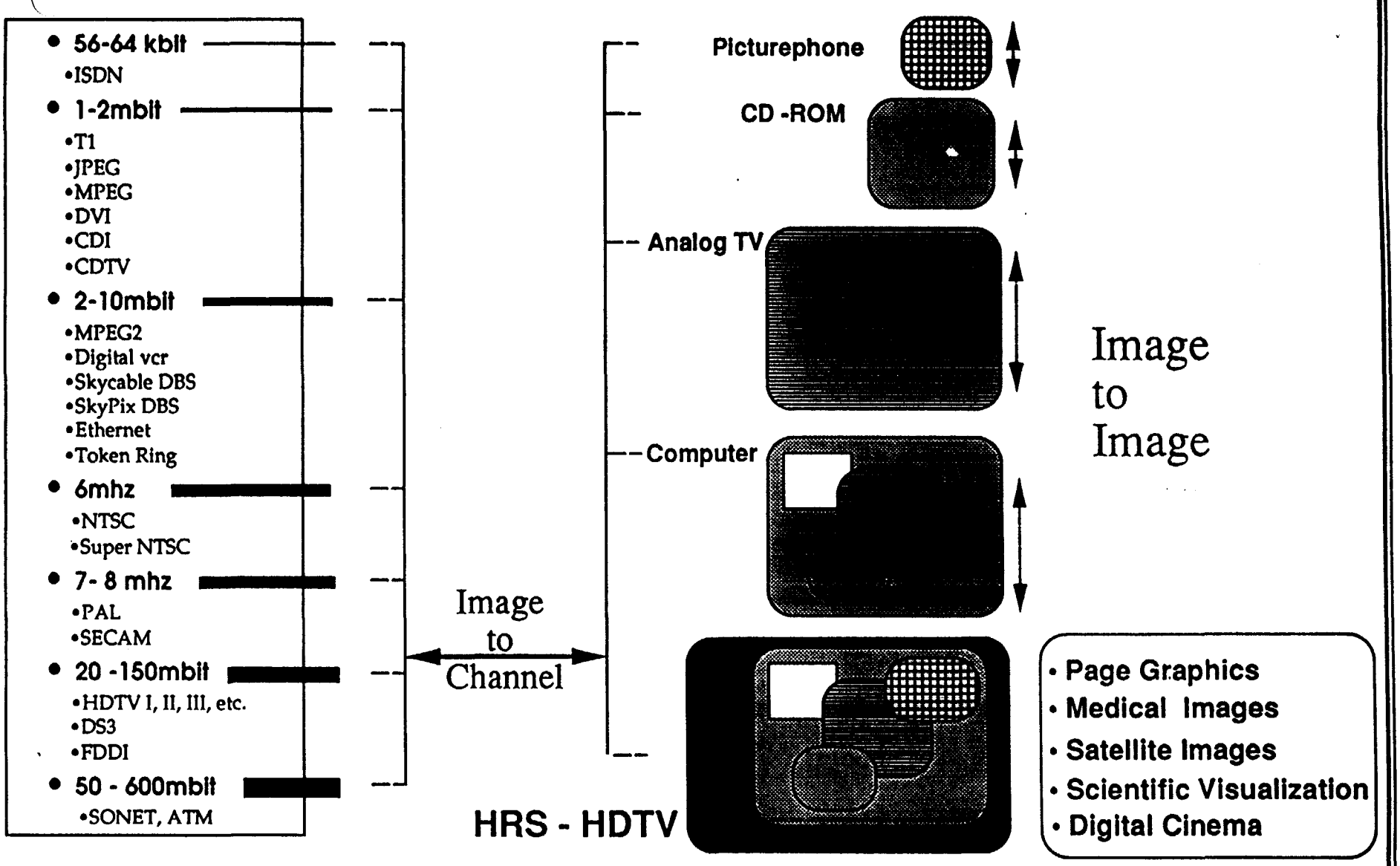
- Film
- CATV
- VCR
- Direct Broadcast Satellite
- C D-ROM
- Video Telephone
- Educational Multimedia
- Page Graphics
- Medical Images
- Scientific Visualization
- Remote Sensing Images
- Local Packet Networks
- Wide Area Packet Nets
- Wide Area Switched Circuits
- Wireless Local Area Nets

Metrics for Prioritization

1. Social Value
2. Economics
3. Timeline

FCC ACATS PS-WP/4 Proposed work plan for fy '92

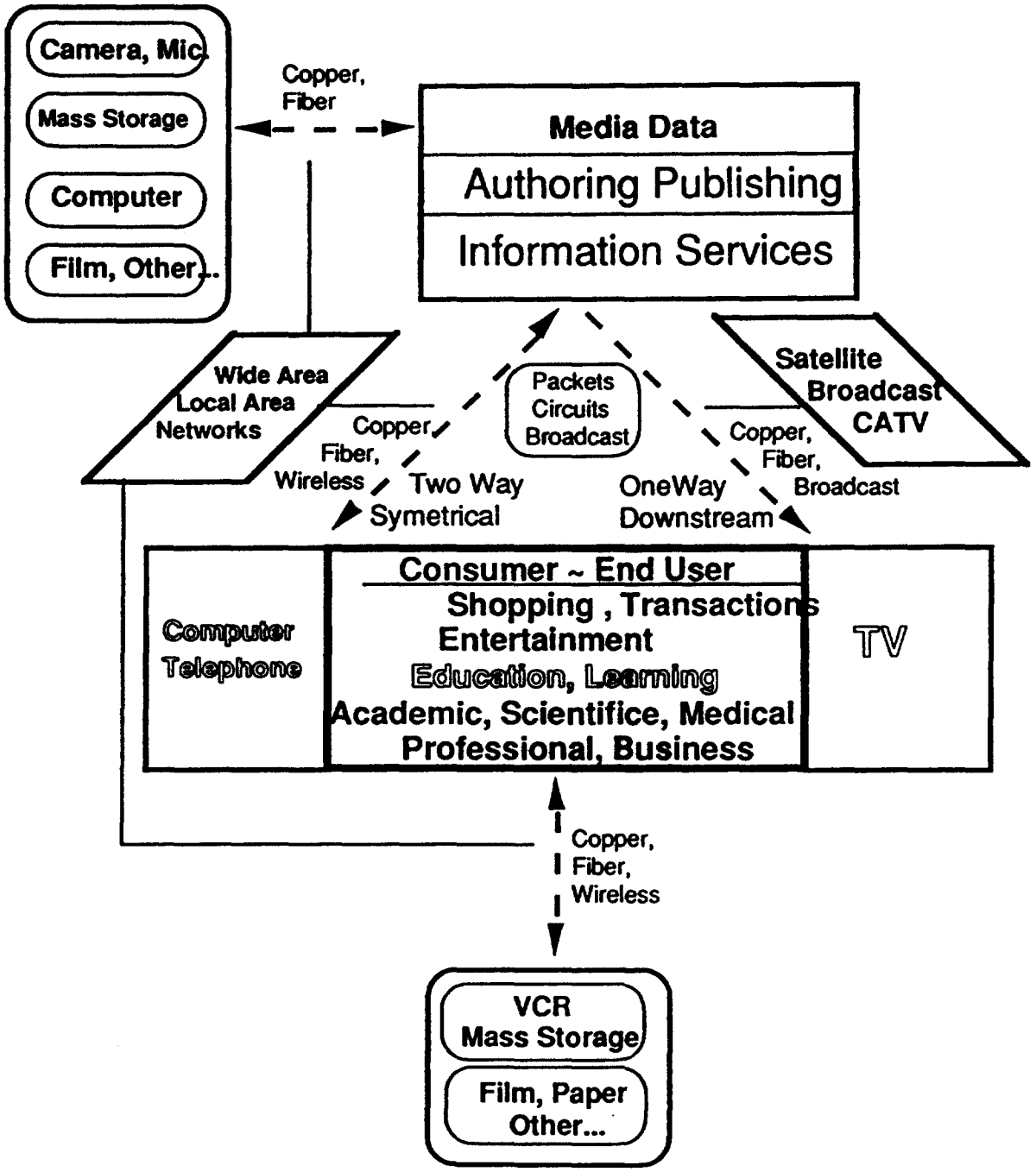
Figure 1



Standard Transformations

Figure 2

A Data-Flow Model



Timeline Deployment of Interoperable Functionality

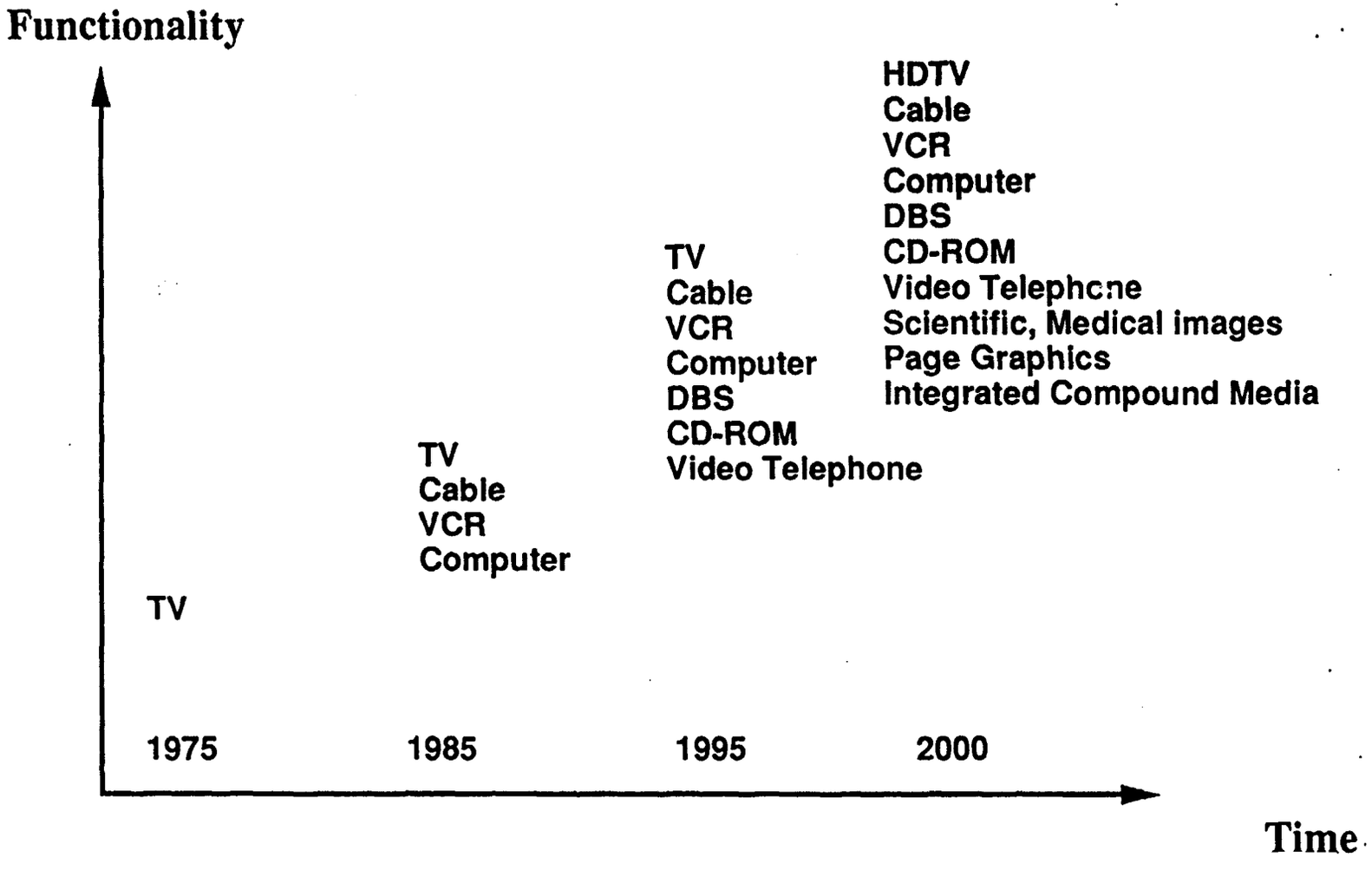


Figure 4

David Sarnoff Research Center

Compressed Digital Video

- **Compressed digital television systems are very different from analog systems**
  - they perform a more difficult job, so they are more complex and have a different structure
  - they are more like data communications than television (as we used to know it)

- **The use of compression firmly decouples transmission (data structures and bit streams) from production and display standards (pixels)**

- **A layered model (analagous to the "OSI model" of data communications) is a useful paradigm**
  - shows the inherent construction of a CDV system
  - identifies different levels where interoperability occurs

Figure 5

Video Reference Sublayer Functions

- Application : Broadcasting, videoconference, videophone, education, medical imaging, animation ...
- Picture : Raster parameters (CIF,QCIF,SIF, CCIR 601...) encryption
- Temporal : Filtering, subsampling, DPCM, motion compensation, 3-D subband
- Spatial : Transform coding, DCT, subband, pyramid, subsampling

Figure 6

Richard Lau
Bellcore

Video Reference Sublayer Functions (Cont'd)

- Code : Variable length code, run-length code, arithmetic code
  lossless coding

- Video packet : Frame structure for carrying video
  information, error correction, handling priority

- Transwitching format:
  Packet switching: BISDN (ATM), FDDI, LAN, MAN
  Circuiting switching: SONET, DS1, DS3, ISDN, SWIFT

- Modulation : Depends on physical media, examples include
  OOK, PSK, FSK, QAM

Richard Lau
Bellcore

Figure 7

David Sarnoff Research Center

A Subsidiary of SRI International

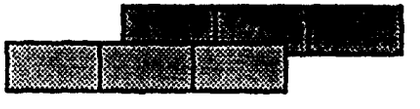
Digital Video Compression "OSI Layers"

Picture

Picture Components

Codes

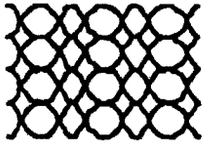
Packets



Bits

11010011101101010100101 1

Symbols



Glenn A. Reitmeier

Figure 8

Transcoding

...Low-Level Transcoding Means Low Cost...

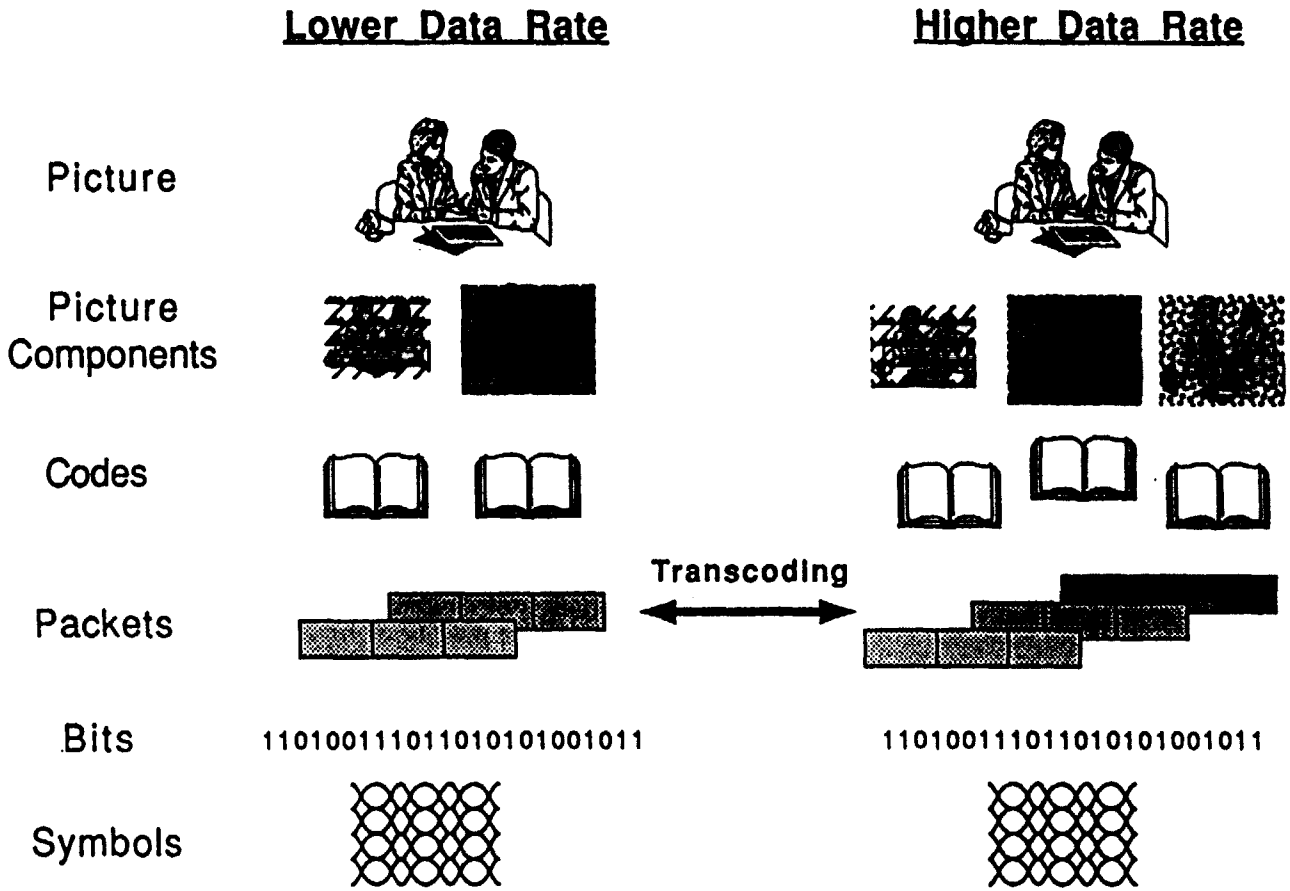
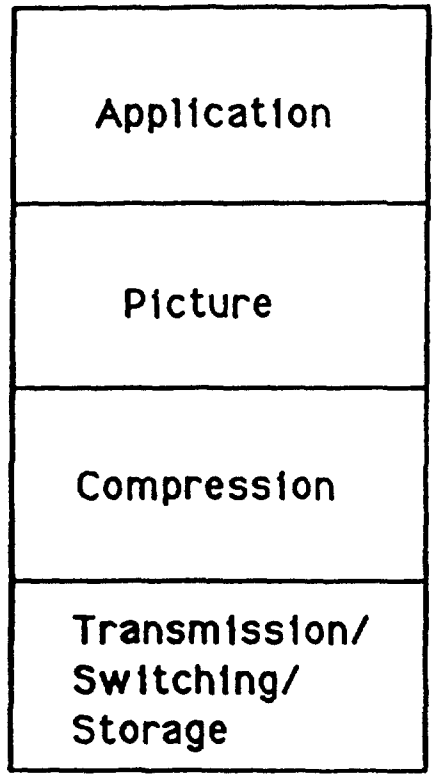
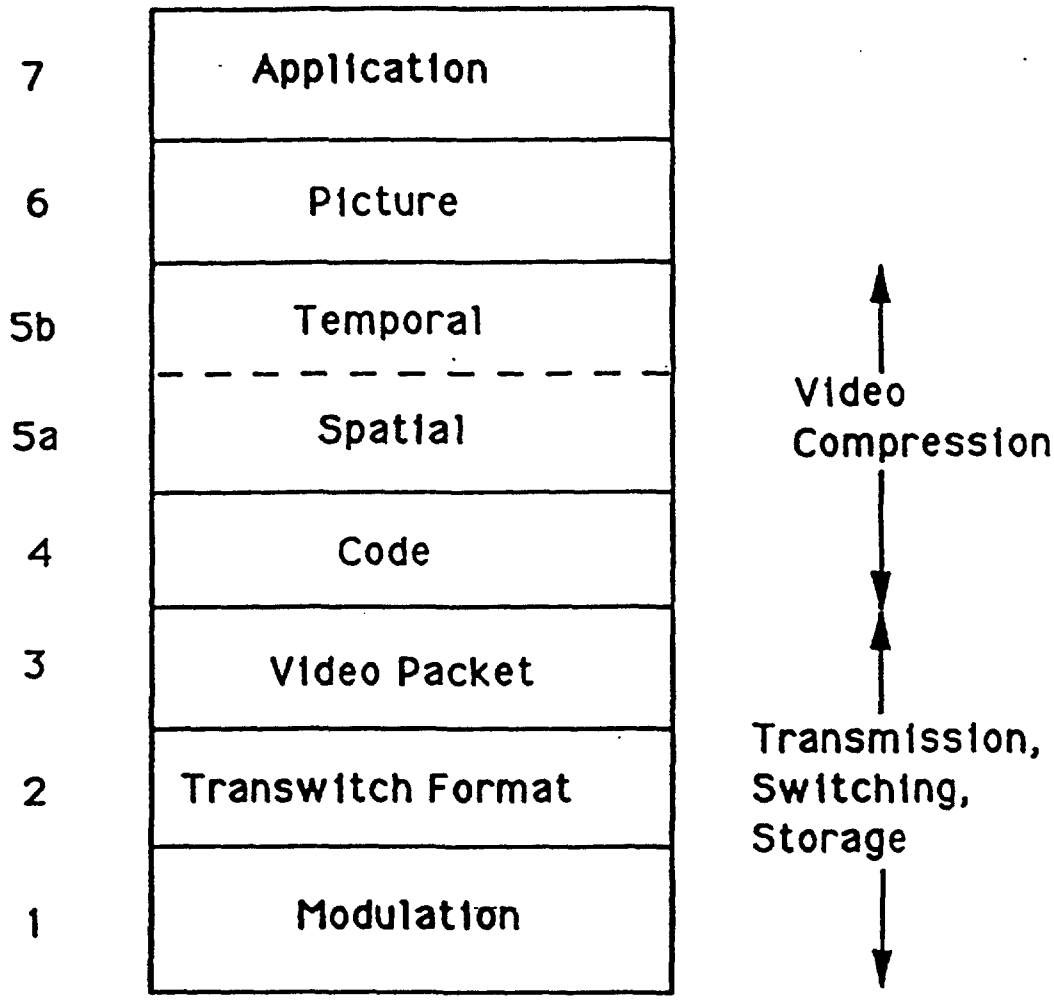


Figure 10



Digital Video Reference Layers

Richard Lau
Bellcore



Digital Video Reference Sublayers

Richard Lau
Bellcore

Inter-Operability:
The Ability of Devices To Work Together

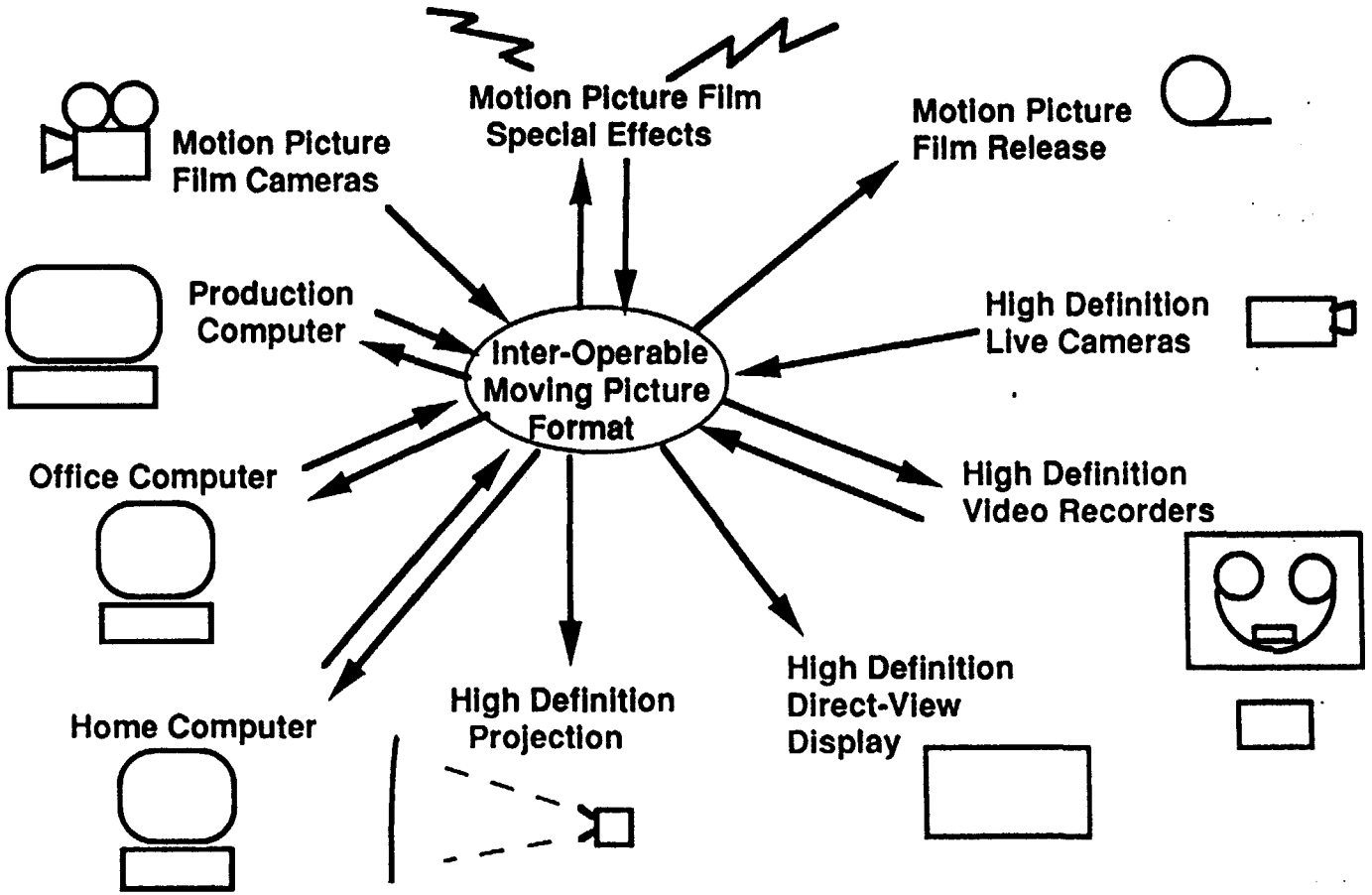
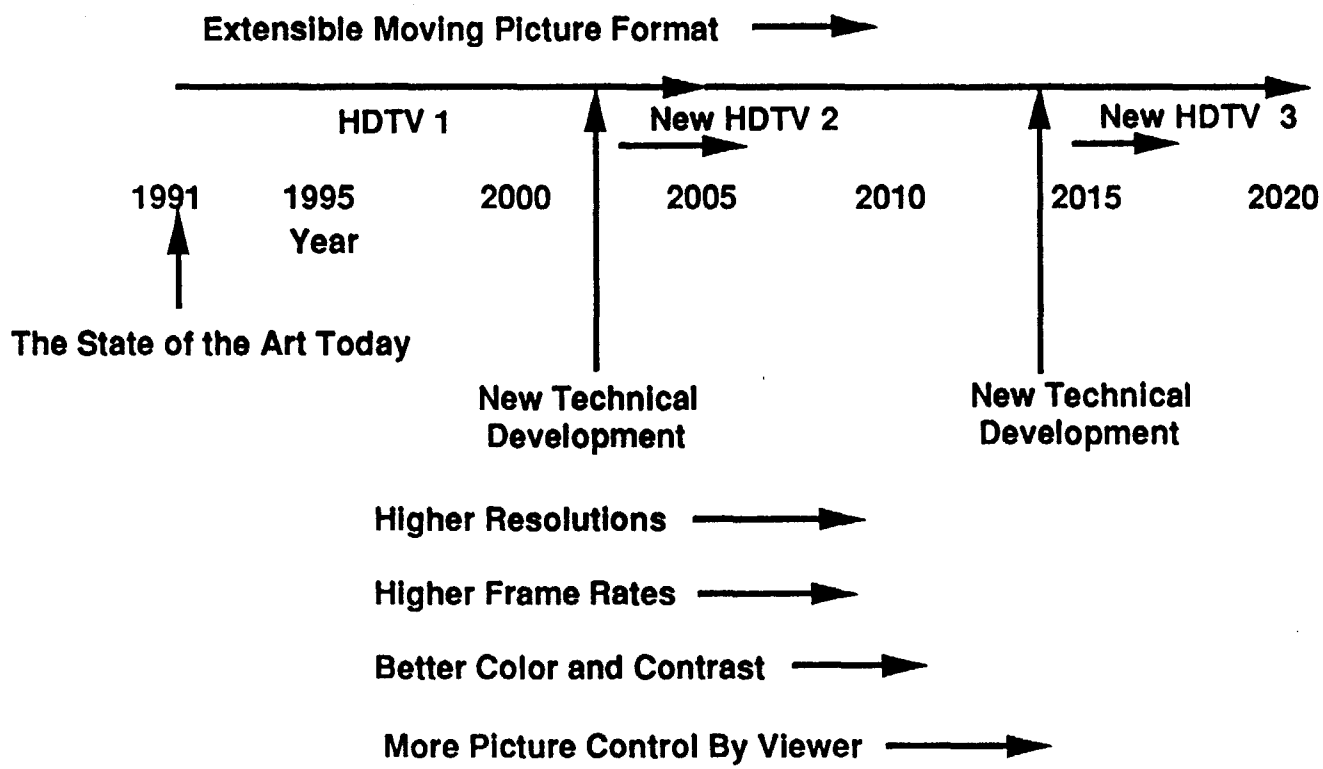


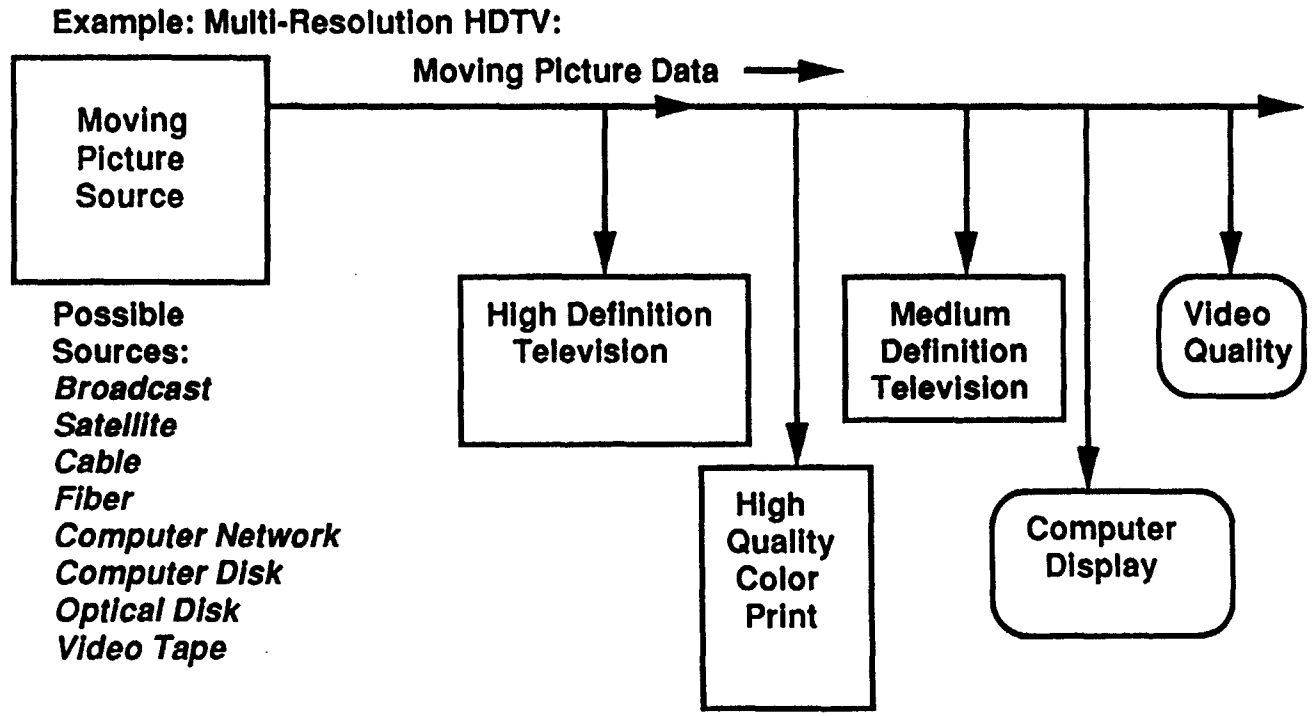
Figure 12

Extensibility:
The Ability of a Format to Advance With Technology



Scalability:

The ability to recieve different resolutions and/or frame rates from a single moving picture format



Scalability:

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